

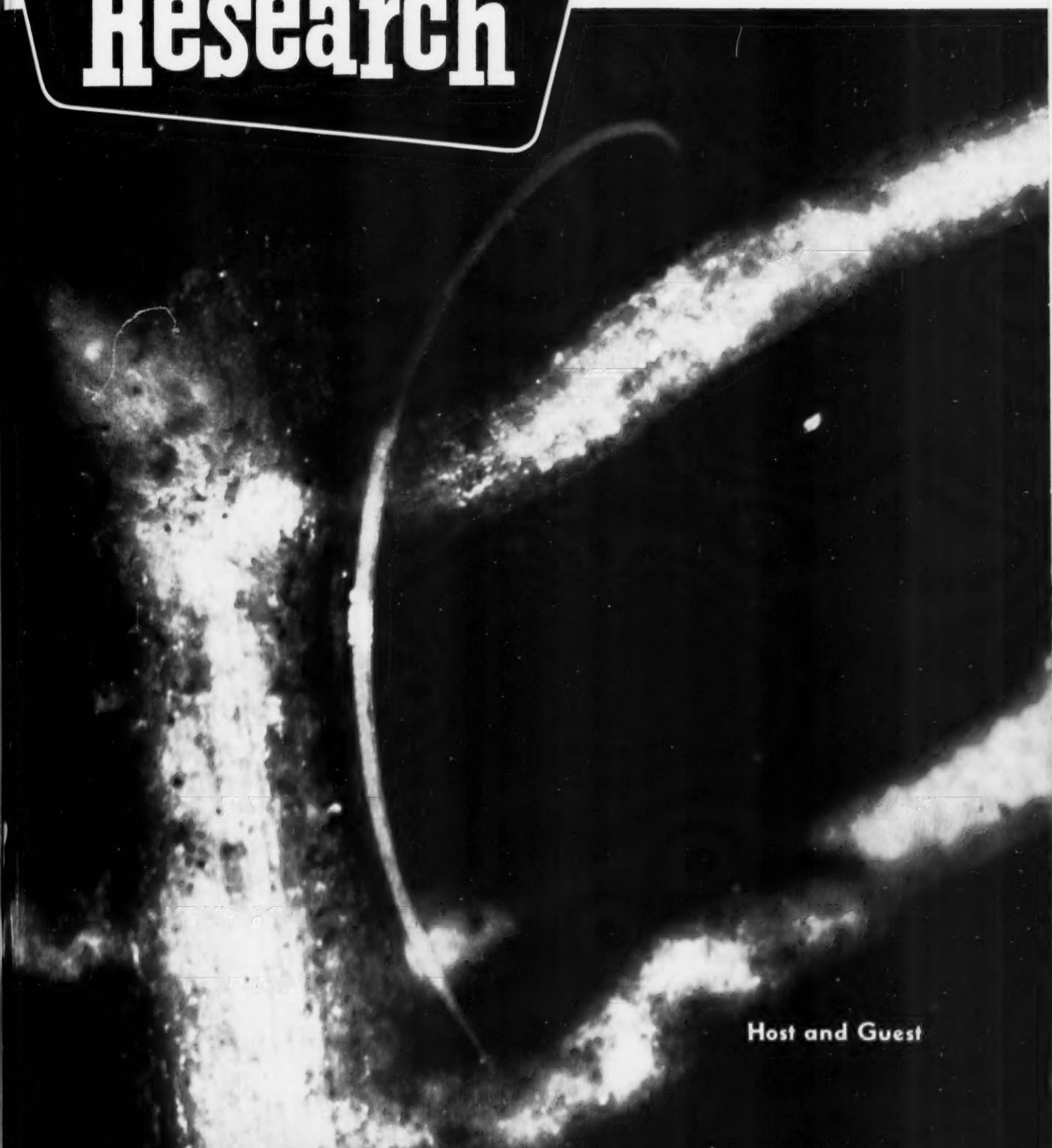
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AGRICULTURAL Research

JULY 1954



Host and Guest

AGRICULTURAL Research

VOL 3—JULY 1954—NO. 1

JOSEPH F. SILBAUGH—MANAGING EDITOR

Ways and means

How can we achieve a better balance in the use of our total agricultural land? Surpluses make this one of today's big farm questions.

No one has the full answer. It *does* seem likely that more of our cultivated land is going to be devoted to producing feed and forage to be turned into livestock products used in the human diet.

In meeting this question, the *first* consideration is to work out a profitable course of action. A farmer isn't going to make a major changeover unless we can give him sound information that shows how this change will increase the income from his land and labor.

That's a job for research, all right.

But it's not the *whole* job. There's a *second* consideration: methods, equipment, and stock to carry through a recommended course of action. Though an individual farmer can solve planning and management problems, he's not equipped to develop new grasses and fertilizers, improved methods of harvesting and preservation, better lines of livestock.

These, too, must be provided through research.

It will take years to complete such a change, even after the course has been plotted. That means there's no research time to lose.

Popular dish

Each of us consumes about 5½ tons of grass a year—enough, in baled form, to fill about two rooms in the average-sized home.

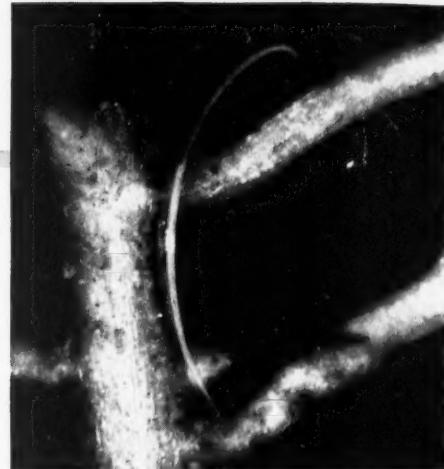
Not grass as such, of course. This figure refers to grass and legumes used to feed the livestock that produces so many items for us. We eat hay, silage, and pasture in the form of milk, cheese, ice cream, and steaks. We wear it as shoes, sweaters, socks, and suits.

If our billion-acre grasslands were suddenly taken away, we'd have only one-third the milk, one-fourth the beef, one-tenth the lamb and mutton we now have. There'd be much less leather and wool.

Grass does other things. It softens floods; reduces the cleaning of ditches, rivers, and harbors; helps lessen the effect of drought.

Each of us, as citizen and taxpayer, has a stake in grass. Fully used, properly handled (see p. 3), it can do even more for us.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture



DAGGER NEMATODE, head buried in the root of a soybean, is one of the countless horde of "eelworms" that cause vast losses in our crops (p. 8). USDA photo by Greeson and Schindler.

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Agricultural Research is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D. C. The printing of this periodical was approved by the Director of the Bureau of the Budget on August 19, 1952. Yearly subscription rate is \$1 in the United States and countries of the Postal Union, \$1.35 in other countries. Single copies are 15 cents each. Orders and remittances should be sent directly to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.



Lay off the GRASS

WHEN Delilah cropped Samson's locks, the Biblical hero lost his strength till his hair grew out again. The same thing happens to grasses, says F. J. Crider, retired nursery division chief for the Soil Conservation Service, at Beltsville, Md.

If you remove too much of the grass' top growth by grazing or mowing it closely, the roots will quit growing until the tops recover.

Crider found this true in testing both cool-season and warm-season grass species. Taking off half or more of the foliage during the growing season caused root growth to stop for a time after each clipping. (The lone exception was orchardgrass following the first clipping.)

A single cutting that removed most of the foliage stopped root growth—usually within 24 hours—for periods ranging from 6 to 18 days. The grass' root growth didn't resume till the top growth was well advanced. Repeating these severe clippings periodically, as in a system of rotation grazing, prevented root growth of all grasses for 25 to 45 days.

The percentage of roots that stopped growing varied with the amount of top that was taken off.

With a single clipping of 50 percent of the foliage, 2 to 4 percent of the grass roots stopped growing for 14 days. After that, all the roots were growing again, and the plants were also producing some new roots. But removing 90 percent of the foliage halted root growth completely for 17 days, and 40 percent of the roots were still inactive at the conclusion of the 33-day experimental period.

Effects of such clippings repeated frequently, simulating continuous grazing, were much more severe.

Removing 50 percent of the foliage and clipping it back to that level three times a week stopped growth of 8 percent of the roots after the first clipping and of 52 percent at the end of the test period. All root growth stopped after the first clipping of 90 percent of the foliage, and subsequent thrice-weekly clippings prevented root growth for the entire test period. Although stoppage was somewhat less as smaller amounts of foliage were removed, no roots were growing at the close of the test where 70 percent or more of the tops had been clipped.

But removing 40 percent or less of the foliage didn't halt root growth. And clipping parts of bunchgrass plants stopped root growth for only those parts. This characteristic would seem to make cattle's "patchy" grazing a desirable habit.

Crider also noted that the number of roots at the end of single-clipping tests ranged from 132 at the 10-percent clipping level to 32 at the 90-percent level. In repeated-clipping tests, the range was from 156 at the 10-percent clipping level to 0 at the 70-, 80-, and 90-percent levels. And he found that among seven types of grasses that were clipped periodically—2 to 4 times during the growing season—dried roots of unclipped plants weighed eight times as much as those of the clipped plants.

Crider believes the damage from repeated heavy clippings is significant in soil conservation and pasture management: reducing the top more than

half upsets the functioning of the root system and the plant as a whole. Because of continuous suppression of aboveground growth, the grass can't replenish its food reserves. So the effects of root inactivity are lasting. The plant thus weakened is less able to resist erosion and grazing, as well as drought, cold, and disease.

This is striking evidence that close grazing or mowing during the growing season—especially in periods of stress or in the late fall—may be practiced at the expense of stand establishment and maintenance.★

PERIODIC CLIPPING of smooth brome stopped root growth, weakened entire plant (left). It had 3 cuttings (to 2½, 2¾, 3 inches), and was allowed to recover after each cutting.





TAMING THE

Castorbean

NATURE was in a frivolous mood when she created the castorbean. She fashioned plants that grow wild as small bushes or 40-foot trees. She made them produce all sizes and shapes of beanlike seeds that shoot or drop from their capsules. She gave these so-called beans attractive coats of variegated colors and made them poisonous to man or beast, their oil a bane to the small boy and a boon to modern industry.

Man began to tame this plant in Biblical times, when the beans and oil became important items of commerce. He succeeded well enough to allow production by hand methods for several hundred years. But taming has had to be carried much further to adapt the plant to mechanized production in the United States.

Behind it all is the growing demand for castor oil. For many years it was used in printing, dyeing, machine lubrication, and medicine. Since the beginning of World War II, chemists have found many new uses. The Armed Forces need castor oil for making flexible coverings for com-

munication wire, airplane-engine lubricants, hydraulic hoist and recoil fluids, and explosives. Commercially, it's used in the manufacture of paints, plastics, and textiles, including nylon and rayon.

Military requirements placed the oil high on the critical list in World War II. Stocks were carefully controlled because most of our supply came from Brazil and India.

Since the war, USDA plant scientists—realizing that castor oil would likely be a critical material in any future national emergency—have continued their work on maintaining seed stocks and breeding plants adapted to the United States.

In 1947 a commercial crusher got interested in establishing a domestic supply. This firm encouraged growers to plant about 7,000 acres in 1950. The crop was used mainly to build up supplies of adapted seed.

With this seed some 75,000 acres were planted in 1951, when the Korean war broke. Acreage increases were constant, and an alltime record of 124,000 acres were harvested in

Arkansas, Arizona, California, New Mexico, Oklahoma, and Texas in 1953. This acreage produced an estimated 24 million pounds of oil.

The 1953 crop represented a triumph for plant scientists and agricultural engineers—Federal, State, and private—whose efforts have made large-scale production possible.

Thanks to breeders, the plants bore little semblance to their wild brethren of the tropics and semitropics. They were even more docile than the cultivated plants of only a few years ago. They grew to a relatively uniform height, produced fruit spikes beginning at a uniform distance from the ground, and yielded more beans. The beans were of uniform size and, in some varieties at least, were far less likely to jump out of their pods than those of previous years.

Machines used to harvest the bulk of the 1953 crop were made commercially after a design developed by USDA engineers in 1951. The original model was improved and manufactured in quantity in 1952.

These machines (see picture) operate on the stripper principle, used widely in harvesting cotton. Occasionally they are fitted with hulling machines that remove the beans from the capsules, deposit the hulls on the ground, and clean the beans ready to take to the crusher.

The combine harvester-huller, used experimentally on the 1953 crop, was also developed by USDA engineers. It greatly reduced the percentage of split and crushed beans, which yield less oil and bring a lower price. This machine greatly reduces hand labor and makes mechanical harvesting and handling of castorbeans comparable to the combining of small grains.

Breeding work is continuing (AGR. RES., July 1953, p. 6) and so is engineering research. The goal is higher production and lower field losses of these unruly beans. Our progress along these lines is encouraging.★

The curious Cotton Fiber

COTTON products with new properties, improved quality, and lower manufacturing costs are growing out of basic research on the nature of the cotton fiber.

At the Southern Regional Research Laboratory, ARS scientists are working on fiber-testing methods and equipment as well as investigations of fiber's physical properties. There are many promising developments.

The latest of these will help us deal with *neps*—the small knots of tangled fibers that form during processing. Neps are difficult to remove and they're one of the main causes of poor fabric quality, particularly in fine goods and dyed fabrics. Any significant decrease in these troublesome tangles will help cotton meet the increasing competition it faces today from synthetic fibers.

Scientists have now developed the Nepotometer (from *Nep-Potential-Meter*), an instrument that predicts the "neppiness" of cottons. C. M. Asbill and J. F. Bogdan, of North Carolina State College, designed the Nepotometer under contract with the Southern Laboratory.

So breeders, processors, and merchants now have a direct measure of nep-forming tendency. This permits cotton selection for the goods to be produced.

Another new tester, the Stelometer, measures both the strength and elongation (stretchability) of cotton fiber bundles. This instrument was developed by K. L. Hertel in research conducted at the University of Tennessee under contract with the Southern Laboratory.

Elongation of fiber bundles is important because of its bearing on the elasticity of fabrics made from the cotton. The Stelometer provides the first practicable means of making such a measurement.

A further advance is J. D. Tallant's mechanization of the Fibrograph, which measures fiber length. This instrument is valuable in finding cottons that are best suited for making special fabrics and threads.

With the modified Fibrograph, a smoother curve (fibrogram) is obtained and a series of tests can be made in 40 percent less time. No basic change need be made for the changeover to automatic operation.

The Cotton Opener, which opens and fluffs matted lumps of cotton from the bale, has been discussed in AGRICULTURAL RESEARCH (Nov. 1953). Industry spokesmen say this machine is one of the outstanding developments in textile equipment of the past quarter century.

In the manufacture and chemical finishing of cotton fabrics, the behavior of an individual fiber is influenced by the nature of its *primary wall*—the thin outer mem-

brane that covers its surface. This wall is the first part of the fiber to come in contact with such factors as soil, dyes, chemicals, and wear.

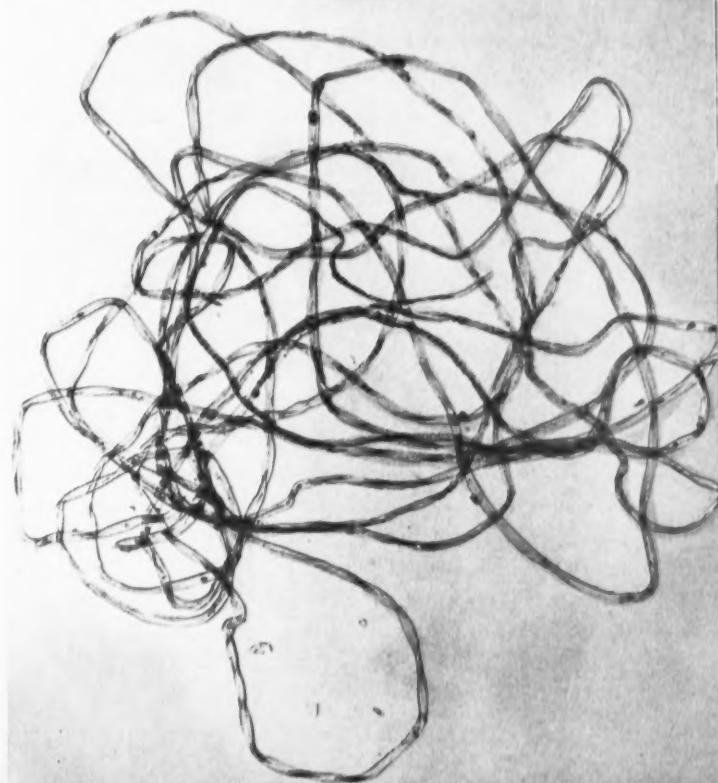
Miss M. J. Rollins and group have perfected a technique to loosen and strip the primary wall from the fiber for testing. This technique has contributed to an understanding of the cotton fiber's properties and helps predict the effects of various processing treatments.

Also important to an understanding of the physical behavior of cotton fibers and fabrics is the fundamental research that's being carried on by E. L. Skau and group on the nonfreezing water capacities of cotton.

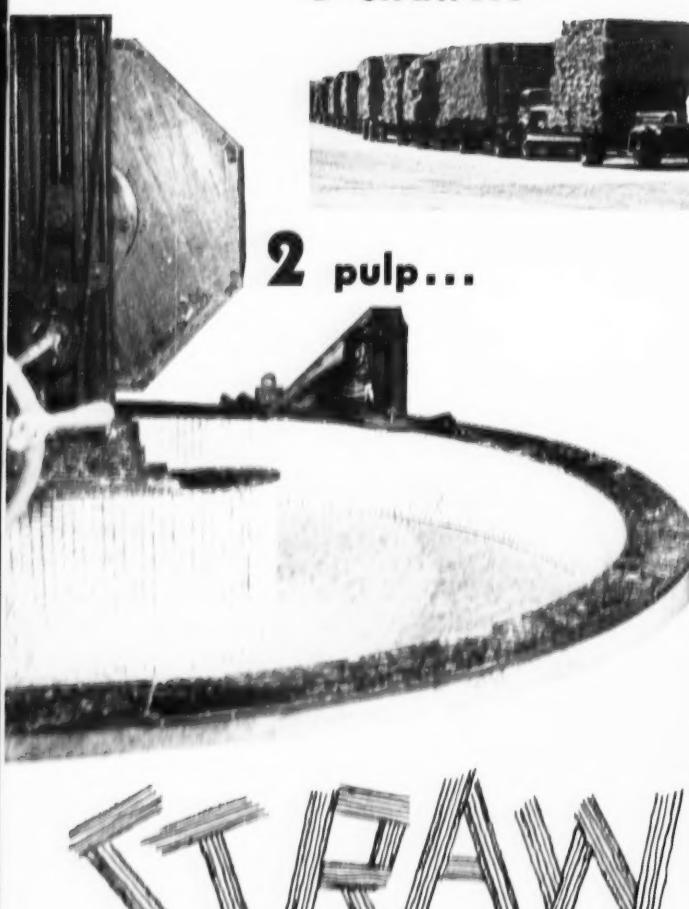
It seems that when cotton fibers are cooled below freezing, *not all* the water in the cellulose will freeze—even at very low temperatures. Data on this cellulose-water relationship has basic importance in a wide variety of cotton-textile problems since fibers are very sensitive to changes in moisture content.

By building up our background of basic knowledge on the properties of the cotton fiber, these developments at the Southern Laboratory and cooperating institutions undoubtedly will lead to further research advances.

SINGLE COTTON FIBER looks like this under a microscope. The actual length of the fiber's 1½ inches—nearly 200 times its width.



1 straw...



2 pulp...



STRAW

... promise for paper

RESEARCH—not alchemy—is turning waste straw into gold for some American farmers. A new paper-pulping method, the mechanochemical process, is responsible.

By this process, developed at the ARS Northern Regional Research Laboratory, straw gives higher yields of pulp than are normally obtained from wood. These agricultural-residue pulps, when blended with woodpulps, top softwood sulfite pulps in most properties and approach softwood kraft pulps in strength. The

process has proved successful in commercial trials for making fine and corrugated papers and newsprint.

This development is important in view of the growing serious pulpwood shortage. Our country is the world's largest user of pulp products, and consumption here has increased 50 percent since World War II.

Grain straws are among the oldest of papermaking materials, dating back to the early Chinese era. But wood has supplanted straw, particularly in the United States, for prac-

tically all types of paper now in use.

To meet the demand, mills have been chewing up soft pulpwoods faster than forests can grow them. Today, the pulpwood supply is short and costs are rising.

Although wood requires years for replenishment, cereal straws are renewed annually wherever grain is grown. Close to 100 million tons of straw are produced on American farms each year. Some of this is used to feed or bed livestock, or is plowed back into the ground. But fully half

NEW MECHANOCHMICAL PROCESS produces pulp from straw in 10 to 20 percent of time used in pressure methods. It reduces labor requirements, steam consumption, and total equipment costs, also lowers safety hazards and insurance rates because pressure vessels aren't needed. Pilot-plant demonstrations were carried out in cooperation with New York College of Forestry, Forest Products Laboratory, and National Bureau of Standards. (Below: S. I. Aronovsky and W. M. Scott, ARS; R. B. Hobbs, National Bureau of Standards.)

3 paper!



of it is now burned or otherwise wasted—enough for all of our country's cellulose needs.

Past research at the Northern Laboratory has developed (1) an improved neutral-sulfite process that makes it possible to get 50 to 52 percent of bleached pulp from wheat straw; (2) a method for producing straw pulp that makes a stiffer corrugating medium than does wood; (3) a simple, economical process using wheat straw for making high-quality insulated building board; and (4) a satisfactory boxboard to replace wood veneer in wirebound containers. The research has also shown that borax will preserve straw in open storage.

By research on the chemical constituents and physical structure of agricultural residues, the laboratory is working toward materials or products superior in their own right—not just substitutes for other raw materials temporarily scarce.

Industry in general has also benefited; costs of shipping containers made of straw have been held lower; strawboard products have been improved; the diversity of potential uses for straw is expected to bring increased utilization.

The high yields of straw pulp made possible by the mechanochemical process brings straw into a competitive position for papermaking. This fact, together with the ever-increasing demand for pulp, paper, and board products, suggest a promising future for straw as a permanent supplementary raw material for fine specialty paper products.

Information prepared by the Northern Laboratory on proper methods of baling and on adaption of efficient one-man pickup balers has made more straw available on farms near the mills. Furthermore, this straw's of better quality and baled at lower cost. Thus, farmers have additional incentive to collect and sell a product that's often completely wasted.★

POULTRY



Breeding for BETTER SHELLS

Hens will lay about 6 billion dozen eggs in the United States this year—but 250 million dozen of them will break or spoil. This annual loss, often running 5 percent, results largely from weak, porous shells.

Weak-shelled eggs have long been an industry problem, and ARS scientists at the Agricultural Research Center, Beltsville, Md., have worked with poultry breeders to solve it.

A hen's ability to lay eggs of desirable shell quality is inherited. It happens that this is a "low" heritability characteristic, making it comparatively difficult to breed and maintain strains that will produce eggs with strong, thick shells.

The first step is to select hens that are laying the right kind of eggs. This means testing the shells. The trouble is that common tests—measuring thickness, weighing the shell, or checking its strength—require breaking the egg.

Poultry geneticist J. P. Quinn and associates have found a less drastic method that holds promise for commercial use. They determine shell quality by checking moisture loss

after 14 days of incubation. This merely applies the fact that eggs with strong, thick shells lose moisture far less rapidly than do those with thin, porous shells. Actual loss can be determined by weighing the eggs or by candling them to determine the size of the air cell.

This method yields results as accurate as those obtained by the egg-breaking methods. Furthermore, by making selections at incubation time, a breeder can improve shell quality in his flock without interrupting his program in other respects.

Quinn and his coworkers are also trying to determine the degree of heritability of this characteristic and how it's affected, up or down the scale, by careful selection and breeding. Starting with stock laying hens of medium shell quality, the scientists were able to breed two widely different strains—one producing good shells, the other producing poor shells—in about 2 years.

An 8-year test shows, however, that the work of building for good shell quality is easily lost if selection and breeding are neglected.★

SHELL TEST: after 14 days incubation

Low weight loss,
Small air cell

STRONG,
THICK
SHELL

High weight loss,
Big air cell

THIN,
POROUS
SHELL



Nemat

EXPERIMENTAL success with a new, practical way of fumigating the soil encourages nematode-plagued farmers and gardeners—but gives little cheer to nematologists, whose recent findings are most sobering.

Microscopic nematodes ("eelworms" or "threadworms"—one-fifth to one-hundredth inch long)—numerically second largest group in the animal kingdom—are present in vast numbers in all soils and bodies of water. Some are free living—move about in the soil and feed on bacterial juices and dead organic matter. Some feed on fungi, bacteria, and protozoa. Some are predators on other nematode species. And others are juice-sucking parasites on plants. Their ravages cost \$400 to \$500 million a year—probably much more.

Soil fumigation, crop rotation, and breeding resistant plants are the major antinematode measures.

For years fumigation has been done largely with two chemicals—D-D mixture (dichloropropene and dichloropropane) and EDB (ethylene dibromide). They have been applied with costly special machinery that will meter out a small amount of liquid evenly over an acre. This limits fumigation to high-value crop land.

Industry, ARS, and North Carolina experiment station scientists have given a practical demonstration of applying the fumigant in a dry mineral (see picture). This

may broaden the economic possibilities of fumigation.

While field testing the new technique under varied conditions and checking chemical effect (if any) of mineral carriers on the soil, scientists are hunting better chemicals for soil treatment.

Each nematode species specializes in food plants—attracts some readily, some reluctantly, and rejects others. Without acceptable ones it generally dies. Discrimination is the nematode's weakness—basis for crop rotation and for breeding crop varieties the parasite doesn't like.

Rotation is effective for a crop with only one or two highly discriminating parasites—effective but costly if it imposes low-value crops on the grower. But if the crop has several parasites, or a nondiscriminate feeder, it's difficult to find suitable crops for the rotation.

Nematode resistance has been bred into some varieties and selections of cotton, cowpeas, soybeans, English walnuts, tobacco, peaches, and other crops.

Taste discrimination helped solve a riddle. Scientists were puzzled to find root-knot nematodes in one locality feeding on certain crops, but in other places feeding on entirely different plants. Close study showed these nematodes, seemingly alike, actually consisted of many species, each with a distinct food taste and a distinct abdominal pattern (see lower left picture).

IDENTIFICATION TECHNIQUE recently discovered by ARS scientists uses distinctive fingerprint-like tail end pattern to differentiate between species of root-knot nematodes, seemingly identical but with widely different food tastes.



FUMIGATION TECHNIQUE just developed—using the liquid chemical in a dry, absorbent silica or vermiculite carrier—may make it practical to treat gardens by hand (below), fields by fertilizing machine. Carrier helps spread a little liquid evenly, slows fuming for better nematode kill.



nematodes-

CROP NEMESIS

Most nematodes leave an egg mass in or near the host plant, assuring the young a start in life. But one group of highly discriminating feeders—the golden and sugar beet nematodes—accumulates the eggs within the mother worm's body and encases them in a heavily encrusted cyst, where they survive for years. The young emerge only on receipt of a mysterious signal (probably a chemical stimulus) that the needed host plant is present.

Cyst nematodes are extremely difficult to control by either fumigation or crop rotation. The scientists have just discovered, however, that a similar, but *wrong* host may entice the larvae to leave their cysts and seek food. The young cannot feed on the wrong plant, so will starve.

Nematologists are planning to try out plant host relatives on some of the more serious cyst nematodes in hope of finding deceptive crops for the rotation. More basically, they want to discover the chemical lures—to duplicate them in the laboratory for use against the pest.

According to G. Steiner, section head, and other ARS nematologists, scarcity of data on crop damage and host range of specific nematodes hampers nematode work. *Crop toll* guides in planning research to advantage. *Host range* is the key to planning crop rotations and finding and using resistant plants in a breeding program.

It takes much basic study—a pair of test plots of each important host plant—to get these facts. Sterile soil and uncontaminated seed or planting stock are required. Controlled infection of a plot in each pair with a species of nematode would measure the parasite's damage.

Important though it is, this would be an exceedingly ambitious undertaking for the Nation's corps of fewer than 25 full-time nematologists and the plant pathologists who can give but limited time to nematodes. At present rates of progress, this information will be slow coming.

PARASITIC NEMATODES—recently reckoned at 100 species, but now at many times that number—cause vast loss. Most nematodes feed in or on the root, but many on stem, bud, or leaf. Endoparasites (1) burrow within the plant and generally stay there—some colonies 100,000 strong—though some emerge and move to new food. Ectoparasites (2 to 5) stay on the surface, bury their heads into the tissue, and suck juice. They sap the plant's vigor, open the way for fungi and bacteria, injure growing points, and cause galls that obstruct the flow of nutrients.

1. Root-knot nematode



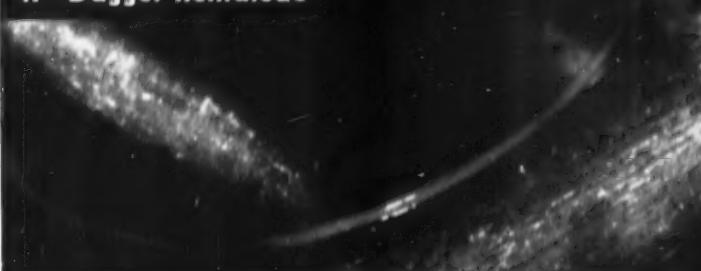
2. Lance nematode



3. Spiral nematode



4. Dagger nematode



5. Golden nematode cysts





NEW ERA FOR

Onions

TWELVE new onion hybrids—fruit of a 3-decade new era in onion breeding—promise to modernize this ancient crop that still depends largely on old standard varieties.

Cooperative research by ARS and experiment station plant breeders in Texas, California, Iowa, Colorado, Indiana, Ohio, New York, and Idaho has now created 14 superior hybrids. Seed companies have developed about 25 others now grown widely.

First of the Federal-State cooperative hybrids, California Hybrid Red No. 1, was released in 1944. Next came Granex, released with the Texas Station in 1952. Then came the 12 northern hybrids whose parent lines are now being increased by seedsmen for farm planting within a few months. The 12, by types, are:

- For the early onion-set area—Early Harvest, an extra-early, rapid-grow-

ing, cool-weather hybrid of quality.

- For the western sweet-Spanish-onion districts—Fiesta, a better keeping, more attractive, more vigorous replacement for the old variety.
- For the Colorado western slope—Pioneer, a highly colored, attractive, tight-scaled, better handling onion than present varieties.
- For the temporary-storage districts in New York, Ohio, Indiana, Michigan, and Illinois—Abundance, Champion, Contender, Elite, and Encore, all of them (especially the first) far better yielders than the old Early Yellow Globe.
- For the late-storage area (Oregon and Colorado to New York)—Aristocrat, Bonanza, Epoch, and Surprise, all better yielders than the standard Brigham Yellow Globe.

H. A. Jones, head of the ARS cooperative onion-breeding project, re-

ports that each of the new hybrids has marked superiority in some respect over the established varieties it will replace. The new hybrid released for the South and many experimental ones under study well illustrate the point. The principal varieties grown when onion breeding started there 15 years ago—Crystal Wax, Yellow Bermuda, and Texas Grano—are susceptible to pink-root disease. They also bear excessive numbers of “doubles” or “splits” (causing lopsided, unmarketable bulbs) and seed stalks (causing hollow-centered worthless bulbs).

Recent Texas tests showed up the hybrids (including experimental ones) in bold contrast to the old varieties. On pink-root-free soil, Granex (an F₁ hybrid between Excel and Texas Early Grano) yielded 369 bags of U. S. No. 1's per acre, compared with 132, 233, and 683 bags,

HYBRIDIZATION IS ATTAINED in the seed crop by growing 2 rows of perfect-flowered breeding line (arrows) between 8-row blocks of male-sterile line. Male steriles are pollinated by perfect-flowered line only. That assures crossing and hybrid seed.



respectively, by the above varieties. Granex produced no culls, but the older varieties produced 260, 265, and 34 bags of culls per acre. In pink-root-contaminated soil, no new hybrid bore more than 14 bags of culls per acre; old varieties bore 213, 103, and 103 bags, respectively.

The big era in onion breeding started with Jones' discovery 29 years ago of a male-sterile onion. The genetic factor for male sterility (or nonproduction of pollen) has been passed to important breeding lines and made commercial hybridization practical. This is now paying off in the release of these new hybrids.

Hybrid vigor increased yield potentials of onions, just as it does in corn. And hybridization depends on avoiding pollen from the plants selected to bear seed. In hybridizing corn, this is accomplished by detasseling the plant by hand.

In onions, sugar beets, grain sorghum (*Agr. Res.*, June 1954), and a few other crops, however, the male



DISEASE-RESISTANT HYBRID, GRANEX (center), outyields parents (left and right) especially in pink-root-disease soil. This is 1 of 14 hybrids bred in cooperative research by ARS and State experiment stations. All are superior to other varieties in areas where they are adapted.

and female parts are crowded too closely together in the flower for practical removal of pollen-bearing organs. By breeding in the genetic factor for nonproduction of pollen, scientists opened the way for hybrids. Male-sterile plants automatically become the female (seed-bearing) crop and are supplied pollen from a selected partner of a different inbred

line to assure a crop of hybrid seed.

Now that hybridization is practical, hundreds of onions having desirable characters—disease resistance, pulp quality, good plant type, productivity, storability, or adaptability to specific areas—are being paired and studied. Hybrids that are superior to some already released should be forthcoming within the next few years.★

Packing WATERMELONS crosswise in car cuts shipping loss

A twist of the wrist is providing a way of substantially reducing damage to rail-shipped watermelons.

Research work by USDA, with the cooperation of growers, shippers, and carriers, has already demonstrated that watermelons packed crosswise in cars arrive in far better condition than those packed in the conventional lengthwise manner.

As a result, the new method is being given a more conclusive tryout during the present shipping season. Investigations this year seek to develop (1) the best methods of crosswise packing, and (2) the range and type of damage to the watermelons shipped by the new method.

Despite the fact that test loading last year was done by inexperienced packers, results were strikingly in favor of crosswise loading.

Detailed reports on the condition of the melons at destination were obtained on 50 crosswise-loaded cars and 52 conventionally loaded cars, shipped from South Carolina, Florida, and Georgia. On the basis of all cars considered, crosswise loading reduced the number of bruised melons by 75 percent, cracked by 69 percent, decayed by 32 percent, and total number lost by 65 percent.

The weight and tenderness of watermelons make them one of the most difficult of fruits and vegetables to ship. Much of the breakage and bruising has been attributed to rough handling of cars, and carriers often have to compensate shippers or receivers for damaged melons.

Agricultural Marketing Service horticulturist J. R. Winston points out that the blossom end of a melon is the

most easily damaged area. Lengthwise packing brings the blossom and stem ends together, so that even a small end-to-end shift of the load can cause considerable damage.

Crosswise packing, on the other hand, brings the watermelons in contact with each other where the rind is thickest and strongest.★





What about

WASHERS and WASHING?

No one type of household washing machine consistently gets clothes cleaner than other types, say ARS home economics researchers. But the way a homemaker handles a washer—for example, size of wash load or water temperature—makes a big difference in performance.

Equipment specialists put 19 washers through their paces in a study that's expected to provide basic guidance for consumer education on selection and use of this increasingly popular appliance.

Comparing the leading types of machine and mechanism (not appraising individual commercial products),

the scientists measured many performance factors. Here are some examples of the problems and findings:

1. Homemakers often load a washer to capacity to save time, water, and detergent. But smaller loads of clothes usually come out cleaner. Results of the study indicate that the best practical solution is to put 6 to 7 pounds of clothes in a washer that can take 8 to 10 pounds.

2. Warnings are frequently issued to homemakers that overloading a machine may damage the motor. This hazard is slight in most washers, the equipment specialists concluded after washing 10-pound loads of bath

towels in machines built to take 8. The biggest disadvantage of overloading is poor washing results.

3. Recommended wash-water temperatures have varied, to homemakers' confusion, and some women try to have the water scalding hot. The experimenters say the higher the temperature the better—within a range of 120° to 160° F. Hotter water damages washer valves and hoses and can cause burns. Heaters usually deliver water within the proper range.

4. Hard water's a problem in many areas. The specialists tested 3 types of detergent (1 soap and 2 synthetic detergents, one high sudsing, one low) in very hard water (300 parts per million of hardness). Though all three were designed for heavy-duty laundry, they differed greatly in soil-removing ability in such water. So it's left to a homemaker to fit type and amount of detergent to the hardness of the local water and the amount of water her machine uses. At present, such adaptations aren't commonly suggested in the directions for machines and detergents.

Details of this study are covered by researchers Enid S. Ross, Katherine Taube, and Dorothy S. Greene in a technical report just issued.★

Properly prepared LEGHORN HEN is tender and flavorful

All too often the little White Leghorn hen is summed up: fine for eggs but not so good as meat.

Yet, millions of mature Leghorns are culled from laying flocks each fall and sent to market. There, shoppers tend to pass them by, seeking fatter fowl—or mistake them for fryers of larger breeds and try frying them with poor results.

Actually, these hens are food bargains and can be tasty and tender if cooked suitably, says ARS food specialist Mary T. Swickard.

Mrs. Swickard and two associates have done some pioneer work in com-

paring eating quality of mature chickens cooked by several household methods. The research team chose those problem birds of the market—Leghorns, aged 18 to 30 months.

Results show relationship of eating quality to three cooking methods—steaming, simmering, pressure cooking—in birds of three quality grades, some fresh frozen and others stored frozen for several months.

The trained judging panel, selected from laboratory staff workers, gave the experimentally cooked Leghorns flavor and tenderness scores that compared favorably with those on the

more popular Rhode Island Red hens. With the cooking methods that Mrs. Swickard standardized, Leghorn hens cooked all three ways gained similar ratings in the important matter of flavor. The Leghorns had a tendency to be more moist and tender when they were simmered or steamed than when pressure cooked; palatability scores and mechanical tests agreed.

Frozen storage for 7 to 9 months took some toll of eating quality. The flavor of the light meat and the tenderness of the dark weren't quite so good as in birds that were cooked and judged when fresh frozen.★



Salt

HOW TO RATION PROTEIN WITH

An increasing number of southwestern cattle are taking their oil meal with considerably more than a grain of salt these days.

That's because an increasing number of cattlemen are adding loose salt—as much as 50-50, in some cases—to regulate the amount of self-fed protein supplement that cattle consume. This way, supplements can be put out weekly instead of daily.

For some years the practice has been followed by scattered cattlemen on a trial-and-error basis. Demand for better information led to research at the Southern Great Plains Field Station at Woodward, Okla.

Considerable information has been gathered, with the cooperation of the Oklahoma experiment station, Salt Producers Association, Carey Salt Co., cattlemen, and others. ARS range ecologist E. H. McIlvaine worked closely with the late D. A. Savage, Woodward superintendent, on range feeding trials.

The scientists found that loose salt, with cottonseed meal or meal-grain mixtures, holds daily consumption to the desired level. "The animals simply stop eating when they have consumed all the salt they can assimilate each day," McIlvaine says.

This keeps animals from overeating protein, and excess salt passes through quickly with no ill effects. Larger, more vigorous animals move on to other grazing after eating their fill, leaving plenty for smaller, weaker, or more timid animals.

The research showed that the required proportion of salt to meal varied with age and weight of animals (see pictograph), quantity and quality of range forage available, length

of feeding period, and the amount of meal intended for daily consumption. McIlvaine believes it generally advisable to separate a herd into reasonably uniform weight groups, to get uniform consumption of meal.

Quantities of salt for different weight classes of steers had to be increased slightly during the winter, when the animals developed a greater tolerance for salt. Similar results were obtained with breeding cows. Less salt was required in summer.

McIlvaine also noted that the better and more plentiful the range forage, the less salt was required for a given rate of meal consumption.

Average winter gains of weaner steers self-fed the salt-meal mixture were 14 pounds less than gains of comparable cattle hand-fed equivalent amounts of protein in pellet form. But a similar experiment with yearling steers showed no significant reduction in summer gains.

The drop in winter gains, McIlvaine suggests, was probably due in part to

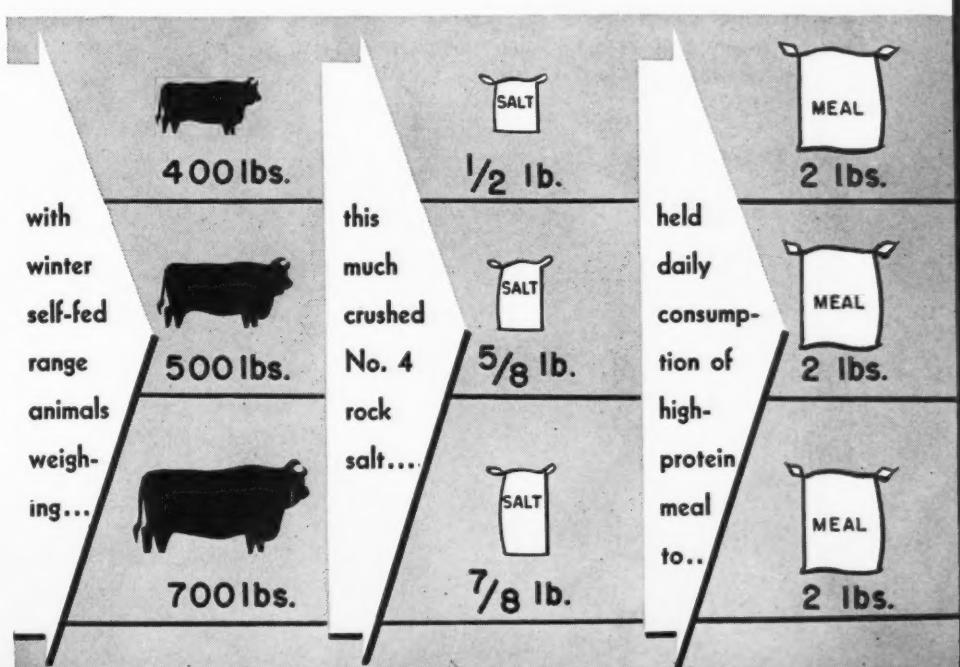
the extra energy required by the salt-fed cattle, which drank twice as much cold water as meal-fed cattle.

Restricted feeding space also may have been involved in the drop. McIlvaine advises stockmen adopting this feeding practice to provide enough bunk space so that half the cattle, or more, can eat at one time.

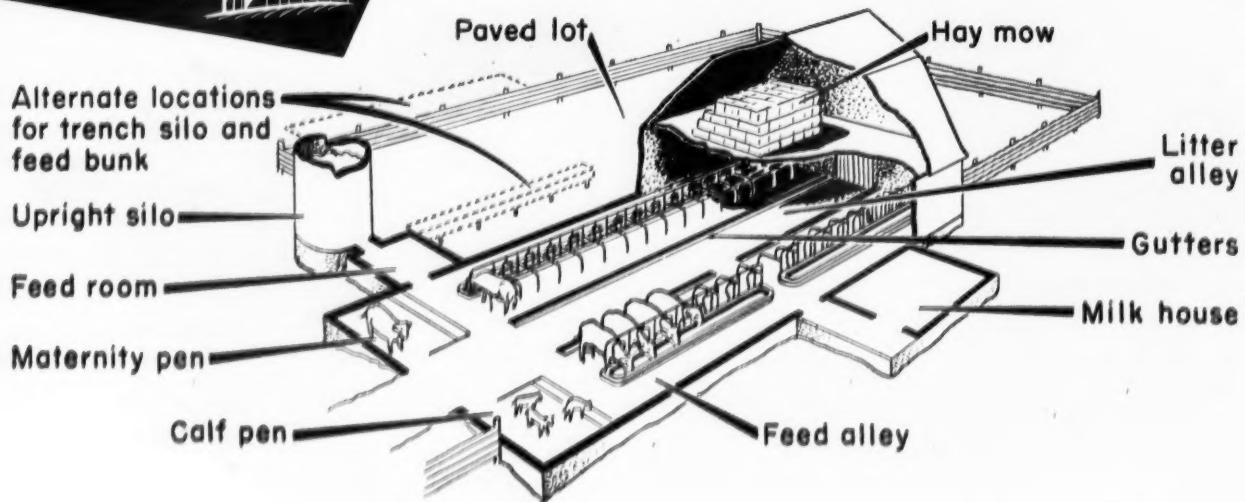
After having been on range supplement of salt and meal for 150 days during the preceding winter and for 90 days in late summer, cattle showed no difference in feedlot gains when compared with similar cattle that had been pellet fed on the range.

There are fewer advantages in the salt-meal method over daily hand feeding when cattle are fed in conveniently located small pastures.

But the method can aid a range feeder. Along with advantages mentioned, a salt-meal mixture helps train calves to eat supplements. And bunks can be placed long distances from water to encourage animals to graze equally over the range.★



DAIRY



TWO-STORY stall barn

IMPROVEMENTS IN THE

Stall Barn

FEED ALLEYS of proper width make feeding easier, save labor: 4 to 5 feet wide in face-in barn (above), 3½ to 4 feet wide in face-out barn (right), exclusive of mangers. Cross alleys need to be at least 4 feet wide in either type to allow for turning feed trucks. It costs less to provide cross alleys at the time of building than later. Feed cart illustrated holds enough concentrate for 55 cows.

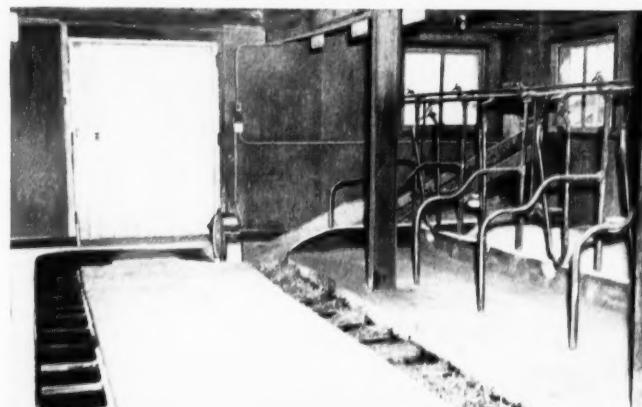


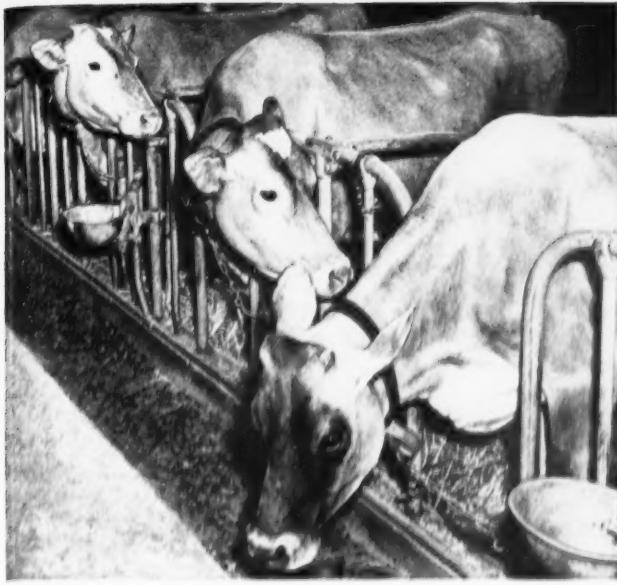
STALL barns are still popular among many dairymen, especially in northern areas of the country. Here, cows usually are kept indoors in winter except for short exercise periods in mild weather.

ARS agricultural engineers, in cooperation with State experiment station researchers, have found that alterations in existing stall barns are often desirable to meet new conditions. Furthermore, improved designs for stall barns are needed because of the changing ways of handling and storing roughage, new types of laborsaving equipment and building materials, and development of larger cows.

Careful planning of a stall barn and related structures will be repaid in laborsavings and extra production, say

LITTER ALLEYS must be built for the job of housecleaning. In face-in barn, the minimum width is 5½ feet. In face-out barn, alley should be 7½ to 8½ feet if manure's handloaded in spreader or wagon (drive-through alley saves up to ¾ loading time). With mechanical gutter cleaner (above), wheelbarrow, or litter carrier, the minimum is 6 feet. Most barns should be planned to accommodate a cleaner.





SWEET-IN MANGER is easy to clean and service as well as less expensive to construct. This type manger runs from 22 to 32 inches in width, but 30 inches is preferable. Tie chain fastened to neck strap gives cow more freedom to lie down comfortably than stanchion. Each water cup serves two cows. Two or more sizes of stalls should be provided where a barn must accommodate cows of different sizes.



HIGH-FRONT MANGER with horizontal pipes prevents hay from being tossed out by cows. Top pipe is vacuum line for the milking machines; bottom pipe is line for water cups. This type manger is usually about 3 feet wide. More milk's produced with less labor in a barn of a given size when stalls are of proper length and width than when more cows are crowded in by making the stalls too small.

engineers Thayer Cleaver, H. J. Thompson, and R. G. Yeeck. Stalls that are too short, for example, make it difficult to keep udders and hindquarters clean. Narrow stalls are largely responsible for teat and udder injuries and may contribute to mastitis. So time and money spent in planning may be saved many times over.

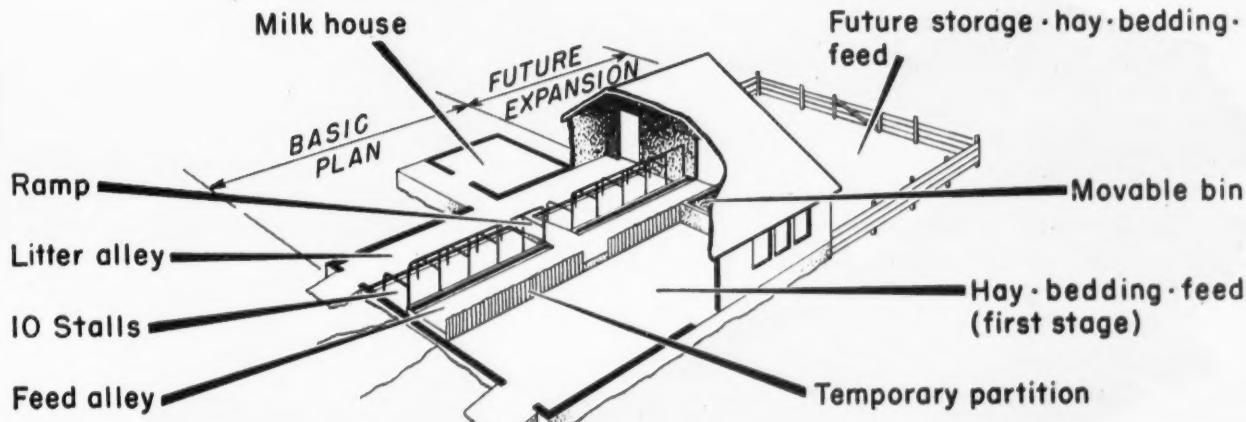
Plans for a stall barn should include such features as feeding facilities, storage for hay and bedding, means of handling and mixing grain and concentrates, type and arrangement of mangers, placement of feed chutes, pens for young stock, and hospital facilities for sick stock.

Facilities need to be fitted to the size of the herd and

the nature of the operation, with possibilities for expansion. Details of design—windows, foundation and floor construction, door placement, insulation, ventilation in winter and summer, plumbing, heating, wiring, and milk-handling facilities—are also important.

ARS engineers have just brought together in USDA publication AIB No. 123, "Stall Barns for Dairy Cattle," the best information available. This is a companion to AIB No. 98, "Loose Housing for Dairy Cattle," issued last summer (see *AGR. RES.*, Aug. 1953).

Both systems—stall barns and loose housing—are satisfactory, and good milk can be produced in either.★



ONE-STORY STALL BARN

Forest
SD
A26
V3
116

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UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D. C.

PENALTY FOR PRIVATE USE TO AVOID
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Notes

AWARDS: for achievement

Seventeen Agricultural Research Service employees and 3 work units were honored for outstanding achievements at USDA's seventh annual Honor Awards Ceremony May 12 in Washington. Awards for 40 years' service were made to 44 ARS employees.

Secretary Ezra Taft Benson presented 158 awards to USDA personnel from throughout the United States.

ARS winners of the Distinguished Service Award:

Human Nutrition Research Branch—DR. ESTHER L. BATCHELDER, for leadership in developing research in food and nutrition and in applying research results to improved national and international utilization of food.

Horticultural Crops Research Branch—DR. GEORGE M. DARROW, for leadership and research contributions to the breeding and improvement of small fruits, thereby providing more dependable, productive, and better quality varieties (AGR. RES., July 1953).

Southern Utilization Research Branch—RALPH A. RUSCA, RAY C. YOUNG, for developing a radically new-type opening machine for lint cotton, which permits the processing of mechanically harvested cotton used in making textiles with less waste (AGR. RES., Nov. 1953).

ARS winners of the Superior Service Award:

Western Utilization Research Branch—G. ALDERTON, discovery of new amino acid in antibiotic subtilin.

Northern Utilization Research Branch—DR. S. I. ARONOVSKY, new technological development for production of paper from agricultural residues (p. 6); R. W. HAINES, devising and adapting photographic methods and techniques to obtain accurate detailed pictures.

Field Crops Research Branch—DR. G. H. COONS, research contributions to the growing of sugar beets through development of disease resistant varieties.

Entomology Research Branch—DR. S. R. DUTKY, for isolating and working out the life history of milky disease of Japanese beetle larvae (AGR. RES., June 1954); DR. F. W. POOS, research that formed basis for control measures for many field-crop insects.

Production Economics Research Branch—G. E. FRICK, preparing and interpreting economic research results to facilitate their use by farmers.

Human Nutrition Research Branch—DR. V. R. GODDARD, for planning, negotiating, and monitoring research contracts in food and nutrition.

Animal and Poultry Husbandry Research Branch—W. J. KREBS, contributions to successful research; DR. D. C. WARREN, for improved poultry production through development of more efficient breeding techniques.

Animal Disease and Parasite Research Branch—DR. A. M. LEE, coordinating research that solved the problem of X-disease of cattle (AGR. RES., June 1954).

Southern Utilization Research Branch—W. A. REEVES, for discovering a new class of phosphorus-containing polymers and for inventing a new flameproofing process for cotton (AGR. RES., May-June 1953).

Budget and Finance Division—E. L. STRUTTMANN, leadership in developing and guiding financial policy, budget and financial structure, and organization for ARS.

ARS work units cited for Superior Service:

Entomology Research Branch—LIQUEFIED-GAS AEROSOL PROJECT, development of liquefied gas aerosol formulations and equipment for control of insects harmful to agriculture and public health (AGR. RES., July 1953).

Eastern Utilization Research Branch—INVESTIGATIONS RESEARCH GROUP, development of simple, inexpensive, and effective process for greatly intensifying flavor of pure maple sirup, leading to new and improved maple products (AGR. RES., Jan.-Feb. 1953).

Western Utilization Research Branch—PEAR CANNERY WASTE PROJECT, developing and demonstrating a successful commercial process and new equipment for utilizing pear cannery waste (AGR. RES., May 1954). *47*